Chemical and physical properties

*Main articles:*[*Properties of water*](http://en.wikipedia.org/wiki/Properties_of_water)*,*[*Water (data page)*](http://en.wikipedia.org/wiki/Water_(data_page))*, and*[*Water model*](http://en.wikipedia.org/wiki/Water_model)

[http://bits.wikimedia.org/static-1.20wmf12/skins/common/images/magnify-clip.png](http://en.wikipedia.org/wiki/File:3D_model_hydrogen_bonds_in_water.svg)

Model of [hydrogen bonds](http://en.wikipedia.org/wiki/Hydrogen_bond) (1) between molecules of water

[http://bits.wikimedia.org/static-1.20wmf12/skins/common/images/magnify-clip.png](http://en.wikipedia.org/wiki/File:Water_droplet_blue_bg05.jpg)

Impact from a water drop causes an upward "rebound" jet surrounded by circular[capillary waves](http://en.wikipedia.org/wiki/Capillary_wave).

[http://bits.wikimedia.org/static-1.20wmf12/skins/common/images/magnify-clip.png](http://en.wikipedia.org/wiki/File:SnowflakesWilsonBentley.jpg)

[*Snowflakes*](http://en.wikipedia.org/wiki/Snowflake) by [Wilson Bentley](http://en.wikipedia.org/wiki/Wilson_Bentley), 1902

[http://bits.wikimedia.org/static-1.20wmf12/skins/common/images/magnify-clip.png](http://en.wikipedia.org/wiki/File:Spider_web_Luc_Viatour.jpg)

[Dew](http://en.wikipedia.org/wiki/Dew) drops adhering to a [spider web](http://en.wikipedia.org/wiki/Spider_web)

[http://bits.wikimedia.org/static-1.20wmf12/skins/common/images/magnify-clip.png](http://en.wikipedia.org/wiki/File:Capillarity.svg)

[Capillary action](http://en.wikipedia.org/wiki/Capillary_action) of water compared to [mercury](http://en.wikipedia.org/wiki/Mercury_(element))

Water is the [chemical substance](http://en.wikipedia.org/wiki/Chemical_substance) with [chemical formula](http://en.wikipedia.org/wiki/Chemical_formula) H2O: one [molecule](http://en.wikipedia.org/wiki/Molecule) of water has two [hydrogen](http://en.wikipedia.org/wiki/Hydrogen) [atoms](http://en.wikipedia.org/wiki/Atom" \o "Atom)[covalently](http://en.wikipedia.org/wiki/Covalent) [bonded](http://en.wikipedia.org/wiki/Chemical_bond) to a single [oxygen](http://en.wikipedia.org/wiki/Oxygen) atom.

Water appears in nature in all three common states of matter (solid, liquid, and gas) and may take many different forms on Earth: water vapor and clouds in the sky; [seawater](http://en.wikipedia.org/wiki/Seawater) in the oceans; [icebergs](http://en.wikipedia.org/wiki/Iceberg) in the polar oceans; [glaciers](http://en.wikipedia.org/wiki/Glacier) and [rivers](http://en.wikipedia.org/wiki/River) in the [mountains](http://en.wikipedia.org/wiki/Mountain); and the liquid in aquifers in the ground.

At high temperatures and pressures, such as in the interior of very large planets, it is argued that water exists as [ionic water](http://en.wikipedia.org/w/index.php?title=Ionic_water&action=edit&redlink=1) in which the molecules break down into a soup of hydrogen and oxygen ions, and at even higher pressures as [superionic water](http://en.wikipedia.org/wiki/Superionic_water" \o "Superionic water) in which the oxygen crystallises but the hydrogen ions float around freely within the oxygen lattice.[[12]](http://en.wikipedia.org/wiki/Water#cite_note-newscientist.com-11)

The major chemical and physical properties of water are:

* Water is a liquid at [standard temperature and pressure](http://en.wikipedia.org/wiki/Standard_conditions). It is tasteless and odorless. The intrinsic [colour of water](http://en.wikipedia.org/wiki/Colour_of_water" \o "Colour of water) and ice is a very slight blue hue, although both appear colorless in small quantities. Water vapour is essentially invisible as a gas.[[13]](http://en.wikipedia.org/wiki/Water#cite_note-12)
* Water is [transparent](http://en.wikipedia.org/wiki/Transparency_(optics)) in the visible [electromagnetic spectrum](http://en.wikipedia.org/wiki/Electromagnetic_spectrum). Thus [aquatic plants](http://en.wikipedia.org/wiki/Aquatic_plant) can live in water because[sunlight](http://en.wikipedia.org/wiki/Sunlight) can reach them. Infrared light is strongly [absorbed](http://en.wikipedia.org/wiki/Absorption_(electromagnetic_radiation)) by the hydrogen-oxygen or OH bonds.
* Since the water molecule is not linear and the oxygen atom has a higher [electronegativity](http://en.wikipedia.org/wiki/Electronegativity) than hydrogen atoms, it carries a slight negative charge, whereas the hydrogen atoms are slightly positive. As a result, water is a [polar molecule](http://en.wikipedia.org/wiki/Polar_molecule) with an [electrical dipole moment](http://en.wikipedia.org/wiki/Electrical_dipole_moment). Water also can form an unusually large number of intermolecular [hydrogen bonds](http://en.wikipedia.org/wiki/Hydrogen_bonds) (four) for a molecule of its size. These factors lead to strong attractive forces between molecules of water, giving rise to water's high [surface tension](http://en.wikipedia.org/wiki/Surface_tension)[[14]](http://en.wikipedia.org/wiki/Water#cite_note-13) and capillary forces. The [capillary action](http://en.wikipedia.org/wiki/Capillary_action) refers to the tendency of water to move up a narrow tube against the force of [gravity](http://en.wikipedia.org/wiki/Gravity). This property is relied upon by all [vascular plants](http://en.wikipedia.org/wiki/Vascular_plant), such as trees.[[15]](http://en.wikipedia.org/wiki/Water#cite_note-14)
* Water is a good polar [solvent](http://en.wikipedia.org/wiki/Solvent) and is often referred to as *the universal*[*solvent*](http://en.wikipedia.org/wiki/Solvent). Substances that dissolve in water, e.g., [salts](http://en.wikipedia.org/wiki/Salt_(chemistry)), [sugars](http://en.wikipedia.org/wiki/Sugar), [acids](http://en.wikipedia.org/wiki/Acid), [alkalis](http://en.wikipedia.org/wiki/Alkali), and some [gases](http://en.wikipedia.org/wiki/Gas) – especially oxygen, [carbon dioxide](http://en.wikipedia.org/wiki/Carbon_dioxide) ([carbonation](http://en.wikipedia.org/wiki/Carbonation)) are known as [*hydrophilic*](http://en.wikipedia.org/wiki/Hydrophilic) (water-loving) substances, while those that are[immiscible](http://en.wikipedia.org/wiki/Miscibility) with water (e.g., [fats and oils](http://en.wikipedia.org/wiki/Lipids)), are known as [*hydrophobic*](http://en.wikipedia.org/wiki/Hydrophobic) (water-fearing) substances.
* Most of the major components in cells ([proteins](http://en.wikipedia.org/wiki/Protein), [DNA](http://en.wikipedia.org/wiki/DNA) and [polysaccharides](http://en.wikipedia.org/wiki/Polysaccharide)) are also dissolved in water.
* Pure water has a low [electrical conductivity](http://en.wikipedia.org/wiki/Electrical_conductivity), but this increases with the [dissolution](http://en.wikipedia.org/wiki/Dissolution_(chemistry)) of a small amount of ionic material such as [sodium chloride](http://en.wikipedia.org/wiki/Sodium_chloride).
* The [boiling point](http://en.wikipedia.org/wiki/Boiling_point) of water (and all other liquids) is dependent on the [barometric pressure](http://en.wikipedia.org/wiki/Barometric_pressure). For example, on the top of [Mt. Everest](http://en.wikipedia.org/wiki/Mt._Everest) water boils at 68 °C(154 °F), compared to 100 °C (212 °F) at [sea level](http://en.wikipedia.org/wiki/Sea_level). Conversely, water deep in the ocean near geothermal vents can reach temperatures of hundreds of degrees and remain liquid.
* At 4181.3 J/(kg·K), water has a high [specific heat capacity](http://en.wikipedia.org/wiki/Specific_heat_capacity), as well as a high [heat of vaporization](http://en.wikipedia.org/wiki/Heat_of_vaporization) (40.65 kJ·mol−1), both of which are a result of the extensive [hydrogen bonding](http://en.wikipedia.org/wiki/Hydrogen_bonding) between its molecules. These two unusual properties allow water to moderate Earth's [climate](http://en.wikipedia.org/wiki/Climate) by buffering large fluctuations in temperature.
* The maximum [density](http://en.wikipedia.org/wiki/Density) of water occurs at 3.98 °C (39.16 °F).[[16]](http://en.wikipedia.org/wiki/Water#cite_note-15) It has the anomalous property of becoming less dense, not more, when it is cooled to its solid form, ice. It expands to occupy 9% greater volume in this solid state, which accounts for the fact of ice floating on liquid water, as in[icebergs](http://en.wikipedia.org/wiki/Icebergs).
* Its [density](http://en.wikipedia.org/wiki/Density) is 1,000 kg/m3 (62.428 lb/cu ft or 8.3454 lb/US gal) liquid (at 4 °C; ice has a density of 917 kg/m3).[[17]](http://en.wikipedia.org/wiki/Water#cite_note-16)

[http://bits.wikimedia.org/static-1.20wmf12/skins/common/images/magnify-clip.png](http://en.wikipedia.org/wiki/File:Label_for_dangerous_goods_-_class_4.3.svg)

[ADR](http://en.wikipedia.org/wiki/European_Agreement_concerning_the_International_Carriage_of_Dangerous_Goods_by_Road) [label](http://en.wikipedia.org/wiki/Dangerous_goods) for transporting goods dangerously reactive with water

* Water is [miscible](http://en.wikipedia.org/wiki/Miscible) with many liquids, such as [ethanol](http://en.wikipedia.org/wiki/Ethanol), in all proportions, forming a single [homogeneous](http://en.wikipedia.org/wiki/Homogeneous_(chemistry)) liquid. On the other hand, water and most[oils](http://en.wikipedia.org/wiki/Oil) are immiscible, usually forming layers according to increasing density from the top. As a gas, water vapor is completely [miscible](http://en.wikipedia.org/wiki/Miscible) with air.
* Water forms an [azeotrope](http://en.wikipedia.org/wiki/Azeotrope" \o "Azeotrope) with many other solvents.
* Water can be [split by electrolysis](http://en.wikipedia.org/wiki/Electrolysis_of_water) into hydrogen and oxygen.
* As an oxide of hydrogen, water is formed when hydrogen or hydrogen-containing compounds [burn](http://en.wikipedia.org/wiki/Combustion) or [react](http://en.wikipedia.org/wiki/Chemical_reaction) with oxygen or oxygen-containing compounds. Water is not a [fuel](http://en.wikipedia.org/wiki/Fuel), it is an end-product of the combustion of hydrogen. The [energy](http://en.wikipedia.org/wiki/Energy) required to split water into hydrogen and oxygen by[electrolysis](http://en.wikipedia.org/wiki/Electrolysis) or any other means is greater than the energy that can be collected when the hydrogen and oxygen recombine.[[18]](http://en.wikipedia.org/wiki/Water#cite_note-17)
* [Elements](http://en.wikipedia.org/wiki/Chemical_element) which are more [electropositive](http://en.wikipedia.org/wiki/Electropositivity) than hydrogen such as [lithium](http://en.wikipedia.org/wiki/Lithium), [sodium](http://en.wikipedia.org/wiki/Sodium), [calcium](http://en.wikipedia.org/wiki/Calcium), [potassium](http://en.wikipedia.org/wiki/Potassium) and [caesium](http://en.wikipedia.org/wiki/Caesium" \o "Caesium) displace hydrogen from water, forming[hydroxides](http://en.wikipedia.org/wiki/Hydroxide). Being a flammable gas, the hydrogen given off is dangerous and the reaction of water with the more electropositive of these elements may be violently explosive.

